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**Post OMB-Review Regulatory Evaluation and Final Rule Changes**

**Collision Avoidance Systems, Docket No. FAA-2001-10910 - 485**

In accordance with Executive Order 12866, following are the substantive changes made to the Regulatory Evaluation and final rule at OMB's request:

- 1) In Section D, Quantifiable Benefits of Collision Avoidance Systems for Air Cargo Airplanes, the FAA added a Sensitivity Analysis
- 2) In Section X, Benefits and Costs Comparison, the FAA revised the discussion of the benefits.

The FAA made accompanying changes in the Economic Evaluation summary in the final rule.

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\$23.5, million with the general aviation (GA) airplane valued at \$500,000 with one GA pilot and with three GA passengers. Given the wide range of seating for commercial airplanes, herein the FAA uses a representative 150-seat airplane with a 75 percent load factor. With such a passenger airplane valued at \$30 million dollars, then an averted midair collision with a cargo airplane is valued at \$396.5 million. The expected averted value of a cargo airplane MAC then is the percent of expected accidents by equipment multiplied by the value of the averted accidents, summed for the three possible cases, or approximately \$27 million in a 20 year time period.

Collateral damage is the damage on the ground that occurs as a result of a MAC. Collateral damage may be the greatest cost of a MAC. However, the costs of collateral damage are very dependent on where the accident occurs. If the MAC occurs over a relatively unpopulated area, the costs of the collateral damage may be relatively low. However, even in unpopulated areas collateral damage can be serious and costly. For example, collateral damage from a MAC could start a fire with ensuing damage. The FAA assumed a low collateral damage estimate of \$1 million, essentially a couple of buildings and no loss of life.

The expected total averted loss equals the sum of expected accident loss by equipment plus the \$1 million collateral damage. This estimate is very conservative in not including emergency response and legal/court costs estimated at approximately \$120,000 per averted fatality. The total expected loss is approximately \$28 million over twenty years. However, operators of approximately 65 percent of the existing cargo fleet have voluntarily equipped their airplanes with TCAS. Therefore, only 35 percent of the fleet will undergo the costs of installing TCAS purely as a result of this rule. Reflecting the voluntary compliance of 65 percent of the air cargo fleet, the total benefit of this rule is reduced to approximately \$10 million (\$28 million multiplied by .35).

#### 4. General Discussion of Benefits

~~Without CAS on all cargo airplanes, the approximated MAC rate is 0.5 per 20-year period, or a 40 percent chance of one or more midair collisions involving a cargo airplane in the same time period. With CAS on all cargo airplanes MITRE estimates that passenger airplanes will experience approximately a 17 percent~~

~~risk reduction. The MAC risk was dramatized by two international accidents and a near mid-air collision with two cargo airplanes, a DC-10 and an L-1011, over Salina, Kansas on March 2, 1999. Sensitivity Analysis~~

~~The estimated expected dollar benefit of this final rule is \$28 million over 20 years. However, because approximately 65 percent of the existing all-cargo fleet is voluntarily complying with the rule, only approximately 35 percent of the fleet will be required to comply with the final rule. Because 65 percent of the air-cargo benefit of \$10 million is the product of an expected accident rate, the percent of the fleet whose operators have not voluntarily complied, and the expected preventable loss of a mid-air collision with a cargo airplane and another airplane. As the above discussion just outlined the value of a preventable industry will voluntarily comply with the final rule, the estimated total benefit of \$28 million is overstated because only 35 percent of the fleet will incur costs because of this rule. Therefore, only 35 percent of the benefits from the final rule can be counted. This results in estimated benefits of .35 X \$28 million or approximately \$10 million.~~

~~The expected benefit estimate is a weighted probability estimate. If the low probability event of a cargo airplane colliding in air with a passenger airplane occurs, then the losses will be real, not estimated. A cargo airplane MAC can easily exceed the cost of a collision avoidance system installed in cargo airplanes. The estimated cost of a MAC involving a cargo airplane and a 150-passenger airplane is \$360 million without collateral damage. While the expected number of MAC accidents prevented is 0.5 over twenty years, there is a 40 percent chance of one or more mid-air collisions with a cargo airplane without a collision avoidance system. As has been discussed above and with the recent DC-10, L1011 air cargo airplanes near mid-air collision over Kansas, this final rule will reduce the real risk of an all-air-cargo airplane mid-air collision with another airplane.~~

~~The high percentage of the all-air-cargo carriers voluntarily complying reduces both the costs and the estimated benefits of this final rule. Since the publication of the NPRM the quantified benefits have been reduced from \$28 million to \$10 million. Even with the voluntary compliance of the all-cargo carriers and with the passenger carriers all equipped with collision avoidance equipment, a significant risk of a MAC still exists. This final rule will reduce the risk of a MAC for airplanes operating in the NAS.~~

While this benefit analysis is based upon a scientific study and provided refined probability estimates and associated benefit estimates, small probability events are difficult to accurately forecast, yet only too painful to measure once the event occurs. The worst MAC occurred in 1996 between a cargo airplane and midair collision is many times greater than \$10 million. This section discusses how sensitive the benefit estimate is to changes in the expected number of accidents.

The above discussion uses a 0.5 expected number of accidents throughout. Earlier in the Pre-TCAS II Accident Rate section the FAA outlined four different methods to establish a reasonable expected number of midair collisions involving a cargo airplane. If the cargo accident rate equaled that of the passenger airplane rate used in the FAA 1988 regulatory analysis of TCAS on passenger airplanes, the expected number of midair collisions involving a cargo airplane was 2.67 accidents over 20 years. The FAA believes that figure is too high, nevertheless 2.67 was the high estimate. The lower bound estimate of 0.1 was based on total cargo departures.

If the accident rate equals 2.67 accidents, instead of 0.5, then the expected benefits increase from \$10 million to \$53.4 million. On the other hand if the accident rate is 0.1 the expected benefits decrease to \$2.0 million.

To further develop the sensitivity range, the expected benefit is based just on a cargo airplane colliding with just one of the three possible airplane types. If the number of expected accidents is 2.67 and the cargo airplane collides with an average passenger airplane, the expected benefit is \$370.5 million. If the number of expected accidents are 0.5 and the collision occurs between two cargo airplanes, the expected benefit is \$4.9 million. If the expected accidents are 0.1 and the air cargo airplane collides with a general aviation airplane, the expected benefit is \$1.1 million.

The sensitivity analysis reveals that various conservative changes to key parameters lower the expected benefits, but these values are relatively close to the base case of \$10 million. On the other hand, changing the parameters to the high end of the range results in substantial increases in estimated benefits. Even though the FAA believes the higher estimates are not likely, the decision risk here is not to underestimate

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passengers and the crews of each airplane) by \$3,000,000, the value of a fatality avoided used in FAA analyses. The cost, estimated in this manner, is \$1,260,000,000. If the value of the airplane and any collateral damage on the ground were added to this estimate, the cost would be considerably higher. In this case, the TCAS very likely averted an accident that could have had a total cost well in excess of \$1 billion.

The benefits of the final rule of the proposed rule, as estimated in Chapter V equal approximately \$10,000,000. This benefit estimate is based upon avoiding a 0.5 air cargo airplane midair collision with another airplane. If the expected number of accidents is reduced to 0.1 avoided midair collisions, then the estimated benefits decline to \$1.1 million. Even though expected benefits are expressed in fractions of a preventable accident, if an accident does occur the benefits can easily exceed the cost of this rule. The costs of the final rule, as estimated in Chapter IX are approximately \$118,000,000.

Despite the estimated quantified benefits being less than the estimated costs, the FAA believes that ~~a strong basis exists for this final rule.~~ the qualitative benefits justify the costs. The facts are that collision avoidance devices have prevented MACs and that ~~such accidents have occurred with cargo airplanes.~~ midair collisions with cargo airplanes have occurred. This final rule will help to reduce the risk of MACs and NMACs. This risk includes six NMACs in 2001, one NMAC of less than 100 feet in 1999 and now two MACs involving cargo and passenger airplanes. Given these circumstances it is not surprising that there is substantial favorable public interest in this rule. This final rule responds to a Congressional mandate, responds to the petition for rulemaking from the Independent Pilots Association, and responds to NTSB safety recommendations. Hundreds of professional airline pilots who commented on the NPRM requested that this rule be implemented as soon as possible. Much of the air cargo fleet is already in compliance with the rule by voluntary action by the carriers and most of the remaining air cargo fleet is scheduled to be in compliance by December 31, 2004.

Therefore, the FAA believes that the benefits of this proposed rulemaking justify

key parameters.

5. Number of Near Mid Air Collisions (NMAC's)

~~passenger 747 jet killing 349 people. On July 2, 2002 an air cargo 757 collided with a passenger TU-154 at 39,000 feet killing approximately 71 people. Unfortunately,~~ the risk of a MAC as measured by NMACs has not declined. Table V-2 shows the reported number of NMAC's involving at least one cargo airplane during the ten year period 1992 through 2001. During this period, there has been a total of 28 NMAC's, or about 3 NMAC's per year. The number of NMAC's has ranged from a low of zero in 1993 and 1995 to a high of six in 2001. ~~Particularly disturbing is the doubling of NMAC's from 3 in 1999 to 6 in 2001.~~ Six NMAC's is particularly troubling given the most recent MAC and the 1999 NMAC with the DC-10 and L1011 cargo airplanes where an eye witness said that the airplanes were 50 to 100 feet apart.

**Summary of Benefits**

This final rule requires that all part 121, 125, and 129 airplanes with a MCTOW greater than 33,000 pounds, operating in the U.S. airspace be equipped with a collision avoidance system. The rule will provide an airspace where virtually all large airplanes are protected by Collision Avoidance Systems which, in turn, reduces the risk of mid-air collisions involving at least one cargo airplane. Further, this reduction in risk could avert an accident with a cost savings many times the greater than the cost of compliance. The recent midair collision in Europe is a sad reminder that reductions in probability and associated benefit estimates pale next to the human and monetary costs of an actual tragedy.

This final rule also responds to a Congressional mandate, responds to the petition for rulemaking from the Independent Pilots Association, responds to NTSB Safety Recommendations, and responds to the hundreds of professional airline pilots who commented on the NPRM requesting that this rule be implemented as soon as possible.